Malting Barley

in

Western Canada

PRODUCTION
HARVESTING
THRESHING
MARKETING

PUBLISHED BY

SEARLE GRAIN COMPANY LIMITED

Foreword

FOUR YEARS AGO, in an attempt to provide something in the nature of a handbook on the production, harvesting and marketing of malting barley, we published the first edition of this booklet.

It was gratifying to find that the booklet was well received and that it appeared to fill a definite need in outlining the requirements of the malting trade and in bringing together some of the more important considerations from the producer's standpoint.

Recent changes with respect to grades, grade requirements, varieties and other matters have necessitated the making of certain revisions. At the same time we have been fortunate in obtaining for reproduction some excellent pictures in colour which show the 'degrading' factors in malting barley.

High quality malting barley is, in many ways, comparable to high quality seed barley and for this reason it must be considered as an 'elite' crop which demands special attention. More and more it is realized that it is not enough to start with good seed of a suitable variety and to grow a crop carefully, following the best cultural practices and so on, unless extreme care is taken in the harvesting, threshing and handling of the resulting crop. With this in mind, a fairly large section of the booklet has been devoted to a discussion of these very important operations.

Mention has also been made of the extensive barley improvement work that is now being conducted throughout Canada and of the progress that is being made in this direction — particularly with respect to quality evaluation and the breeding of still more acceptable varieties.

It is our sincere hope that this booklet will continue to be of use to those who raise malting barley and that it may contribute to the improvement of quality in this valuable crop which has come to occupy such an important position in the Western farm economy.

WINNIPEG, MANITOBA,
MARCH, 1961.

W. G. MALAHER, DIRECTOR,
RESEARCH DEPARTMENT,
SEARLE GRAIN COMPANY LTD.

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The Malting and Milling Industries

Domestic and Export Demands

The pattern of the past five years with respect to the production of barley in Western Canada and the demand that has existed for those types of barley suitable to the malting and milling trades, both in Canada and abroad, is of interest in considering the broad general picture.

During the past five seasons, Western Canada has grown an average annual crop of 226 million bushels of barley of which some 60% or 135 million bushels has consisted of the six-row varieties, O.A.C. 21, Montcalm, Olli and Parkland—all of which are suitable for malting. Another 14% of the total crop, or an average of close to 32 million bushels annually, has consisted of the two-row varieties, Hannchen and Compana, used chiefly in the pot and pearl barley and the milling trades. During the same period, deliveries average 113 million bushels of all types of barley of which some 35% or 40 million bushels found their way into the malting trade, either in Canada or in the U.S.A. At the same time, an average of between 6% and 7%, or some 7 million bushels were absorbed annually by the domestic milling trade or were exported to Japan, where the barley was processed for human consumption.

It will be noted from these figures that an important part of the barley crop delivered at country elevators, roughly 40%, has in recent years been used for malting and milling either at home or abroad. This demand, both from the malting market and the human food market, is based primarily on quality considerations and it is, therefore, of the greatest importance that farmers should strive to produce barley of a quality that will be acceptable to buyers in these markets. Only in this way, can the position of barley as an important source of cash farm income be protected.

Grades

The better quality varieties of six-row barley produced in Western Canada are used for malting and the two-row varieties are used mainly for pearling and to a lesser extent for malting, particularly in the overseas business. The statutory grades, that is, the grades defined in the Canada Grain Act for these classes are: **No. 1 C.W. Six-Row, No. 2 C.W. Six-Row, No. 3 C.W. Six-Row, No. 1 C.W. Two-Row and No. 2 C.W. Two-Row.** There is also a commercial grade of **No. 3 C.W. Two-Row Barley** established by the Committee on Western Grain Standards. Present requirements of the malting and pearling grades are as follows:

STATUTORY AND COMMERCIAL GRADES OF WESTERN BARLEY

(Related to Malting or Pearling Quality)

STANDARD OF QUALITY					MAXIMUM LIMITS OF FOREIGN MATERIAL			
Grade Name	Minimum Weight per Measured Bushel in Pounds	VARIETY	Minimum Percentage of Variety or Type	Degree of Soundness (See Note)	Seeds (See Note)	Wild Oats	Other Grains	Total Not to Exceed
No. 1 Canada Western Six-Row	50	Any Six-Row variety equal for malting purposes to O.A.C. 21	95	Sound, well matured, may contain slightly weather-stained kernels	Practically free	About ½%	About 1%	About 1%
No. 2 Canada Western Six-Row	48	Any Six-Row variety equal for malting purposes to O.A.C. 21	90	Sound, reasonably well-matured may contain weather-stained, but not badly discoloured kernels	Practically free	About ½%	About 1½%	About 1½%
No. 3 Canada Western Six-Row	46	Any Six-Row variety of fair malting quality	85	Practically sound, reasonably well-matured, may contain weather-stained kernels	About 1%	About 1%	3%	4%
No. 1 Canada Western Two-Row	51	Any Two-Row variety equal for pearling or malting purposes to Canadian Thorpe	95	Sound, well matured, may contain slightly weather-stained kernels	Practically free	About ½%	About 1%	About 1%
No. 2 Canada Western Two-Row	49	Any Two-Row variety equal for pearling or malting purposes to Canadian Thorpe	90	Sound, reasonably well-matured, may contain weather-stained, but not badly discoloured kernels	Practically free	About ½%	About 1½%	About 1½%
No. 3 Canada Western Two-Row	47	Any Two-Row variety of fair malting or pearling quality	85	Practically sound, reasonably well-matured, may contain weather-stained kernels	About 1%	About 1%	3%	4%

Sound—Shall mean practically free from frosted, free from sprouted or heated kernels, and shall be reasonably free from broken, skinned or otherwise damaged kernels.

Seeds— All grades shall be practically free of seeds and other material removable through a sieve with a 4½/64-inch round perforations. The percentage tolerance of seeds specified in the grades shall refer to large seeds, such as wild buckwheat.

Grading Factors

Peeled and Broken Barley

GRADE	MAXIMUM PER CENT (Peeled and Broken Kernels)
1 C.W. Six-Row	3%
2 C.W. Six-Row	4%
3 C.W. Six-Row	4%
1 C.W. Two-Row	3%
2 C.W. Two-Row	4%
3 C.W. Two-Row	4%

The maximum tolerance of peeled and broken kernels in the grades of 2 C.W. and 3 C.W., Six-Row and Two-Row, is 5% in the case of shipments out of terminal elevators. This takes care of a normal increase of 1% in peeled and broken kernels during the handling, including cleaning, in the terminals.

Plump and Thin Kernels

	Minimum Percent Plump	Maximum Percent Thin
No. 1 C.W. Six-Row	70	4
No. 2 C.W. Six-Row	70	4
No. 3 C.W. Six-Row	60	5
No. 1 C.W. Two-Row	70	4
No. 2 C.W. Two-Row	70	4
No. 3 C.W. Two-Row	60	5

Plump barley is barley which remains on top of a 6/64-inch x ¾-inch slotted sieve.
Thin barley is barley which passes through a 5/64 inch x ¾-inch slotted sieve.

Allocation of Varieties

Grade:	Eligible varieties:
No. 1 C.W. Six-Row No. 2 C.W. Six-Row	O.A.C. 21, Mensury, Olli, Manchurian, Montcalm, Vega, Gateway, Parkland.
No. 3 C.W. Six-Row	O.A.C. 21, Mensury, Olli, Manchurian, Montcalm, Gartons, Peatland, Vega, Gateway, Parkland.
No. 1 C.W. Two-Row No. 2 C.W. Two-Row	Canadian Thorpe, Hannchen, Charlottetown 80, Betzes.
No. 3 C.W. Two-Row	Canadian Thorpe, Hannchen, Charlottetown 80, Rex, Sanalta, Compana, Betzes, Palliser.

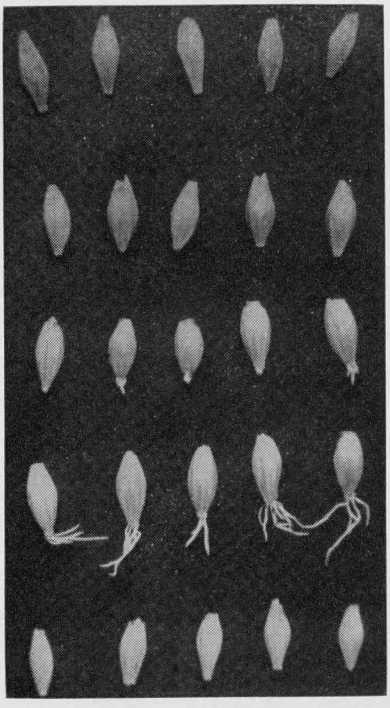
Quality Factors in Malting Barley

Barley which is to be used for the production of malt must meet certain quality standards and in some respects these are different and more exacting than for some other grains entering commercial channels. Before enumerating the qualities that are looked for by the maltster it will perhaps be helpful to give a very brief description of the malting process which will help the reader to understand more clearly the reasons for the high quality required in malting barley.

How Malt Is Produced

The malting process is a carefully controlled method of germinating barley during which certain chemical and physical changes take place within the kernel. The process referred to increases the activities of the enzymes, or digesting agents, which act upon the protein and starch within the kernel producing water-soluble starches and sugars. The barley is first steeped or soaked until the kernels have absorbed about 45 per cent moisture. Uniform vigorous germination is then necessary to bring about the conditions the maltster requires.

THE MALTING PROCESS



Raw Barley

Steeped Barley

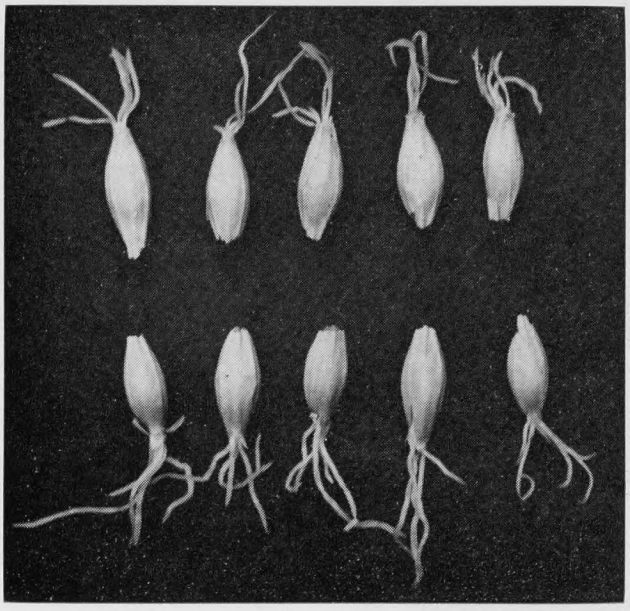
Chitted Barley
(with germ just beginning to emerge)

Fully Grown Malt
(germinated)

Malt

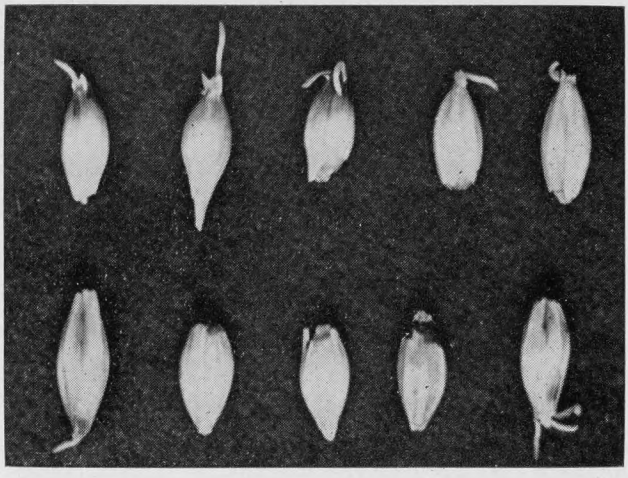
Growth is allowed to take place until all the kernels have produced short rootlets about three-quarters of an inch long and the sprouts have grown under the hull to almost its full length. The green malt is then dried rapidly and the rootlets are removed, the malt being stored for future use. The ker-

nels should be such that they will absorb sufficient water in the required steeping time and they should also all germinate at the same speed and have the same starch conversion time and so on.



Vigorous, uniform germination

Weak uneven germination



What the Maltster Requires

It will be realized from what has been said that only uniform, well-matured barley that is sound and free from damage of any kind will meet the requirements of the maltsters. Apart from the proper type, or variety, therefore, the various physical characteristics which the maltster looks for are as follows:

Plumpness:

Since fat, plump kernels contain a high percentage of starch and in turn manufacture into a malt with high extract, a plump barley is important.

Uniformity:

Uniform medium-sized kernels which have good hull adherence and good colour carry with them the requirements for satisfactory germination. Complete uniformity of size cannot be obtained in a six-row barley but the aim should be for the highest degree of uniformity possible.

Sound Barley:
Well matured and uniform.

Maturity:

Green immature samples do not modify readily on the malting floor. They will not germinate evenly and are more likely to have loose hulls and starch which is not well matured. Maturity is denoted by a fine wrinkle of the hull together with a bright, mature appearance.

Freedom from Weathering and Seed Borne Diseases:

Weathering in the field tends to lower germination and anything which tends to destroy the germinating power of barley reduces its value for malting purposes. For the same reason, good malting barley should be free of mildew and greying, smut and, of course, frost. Sprouting in the field is also undesirable since once a barley is sprouted it refuses to grow satisfactorily again.

Dryness:

Dry barley in Canada contains 14.8% moisture or less. Such barley can be stored and kept without going out-of-condition and since out-of-condition barley means lower germination, buyers look for dry barley so as to be sure that the germination has not been lowered due to the growth of often-times invisible mould growth.

Freedom From Threshing Damage:

Peeled or cracked kernels sprout fast because they take up water more rapidly and in addition the sprouts grow out of the breaks in the hull allowing the young shoots to be exposed and broken off when the germinating grain is stirred. This stops the conversion process in the kernel. Grain with injured ends, too, may not germinate; hence the quality of the malt will be lowered. The hull is required to provide drainage in the mash and it also protects the kernel and germ during the germination period. Thus, peeling of the kernels at the awn end, caused by poor threshing or cleaning, may allow the entry of moulds which may grow rapidly during malting and which may be detrimental. Freedom from undamaged kernels, therefore, is very important to the maltster.

Harvesting and Threshing Malting Barley

Many farmers, well located from the standpoint of producing malting barley, are able to grow barley that will measure up to all the requirements of the trade — until they harvest the crop. Then, because of faulty harvesting procedure or improper threshing, their otherwise good malting barley becomes damaged and, in many cases, drops to a feed grade. Although it is difficult to make an estimate of the total loss which occurs because of poor harvesting and threshing methods, it is considerable. From the standpoint of the individual, one has only to assume that if a certain combine threshes 1,000 bushels per day and causes mechanical damage to the grain which makes it unacceptable for malting this, at present day prices, would mean a loss of some $120.00. Such a loss would be due to the spread in price between malting barley and feed barley grades and loss of the malting premium.

Generally speaking, the losses referred to are due to: (1) cutting at the wrong stage of maturity, (2) faulty methods of swathing and (3) improper adjustments and rates of feeding the combine. These faulty practices will be discussed in order. Many of them seem to result either from failure to appreciate in the first place just what constitutes good malting barley or from failure during harvesting and threshing, to observe the proper precautions which are so necessary if the best possible sample is to be obtained.

Stage of Maturity

Because of the importance of maturity to the maltster who prefers a plump, mature kernel, the crop should not be harvested on the green side. Immature, lighter weight kernels, in fact, are not desirable in the malting process. Thus care should be taken to delay swathing until the kernels have turned in colour and the moisture content is down to somewhere between 30 and 35%. In the case of some of the older malting varieties which had a tendency to "shatter" and to "neck", particularly if the weather was dry or high winds prevailed, harvesting was often done on the green side — a practice which sometimes resulted in a considerable loss to the grower. With the introduction of Montcalm, Olli and Parkland, which do not shatter readily or have the same tendency to "neck", the crop may safely be left standing for a longer period of time in order to ripen.

Swathing

Experience has shown that swathing the crop is a safer method than straight combining, particularly if there are many green weeds in the field. It is important that the width of the swath be adjusted to the weight of the crop being harvested; thus a heavy crop may be placed in a wide swath while a light crop must be held together in a narrow swath. Careful adjustments are, therefore, needed to bring this about. The length of the stubble should be such that it will keep the swath off the ground but it should not be so long that it will collapse under the weight of the swath.

The grain should be permitted to complete drying and maturing in the swath until the kernels are a bright colour and the moisture content is 14.5% or under. It is essentially true that as the barley becomes drier the tendency to dehull increases, but under actual field conditions alternate drying and wetting, which produces contraction and expansion of the kernel, is a major contributing factor to loosening of the hull. Very often even a light shower seems to increase this tendency to peel. Moreover, if the harvesting of swathed barley is delayed until after it has been exposed to two or three showers it will, in many instances, be no longer suitable for malting. Because of this malting barley should be given priority in the harvesting schedule. The operator should keep a very careful check on the drying of the swath so that no time should be lost once the grain is dry enough to thresh. In normal dry weather this should be within 4 to 7 days after cutting.

Tough or damp barley is not suitable for safe storage and will develop moulds which make it undesirable for malting purposes. If the stand is too thin to form a good swath, however, it will be better to leave the crop for straight combining since losses will be high and damage to the sample may result from a thin swath lying in contact with the ground.

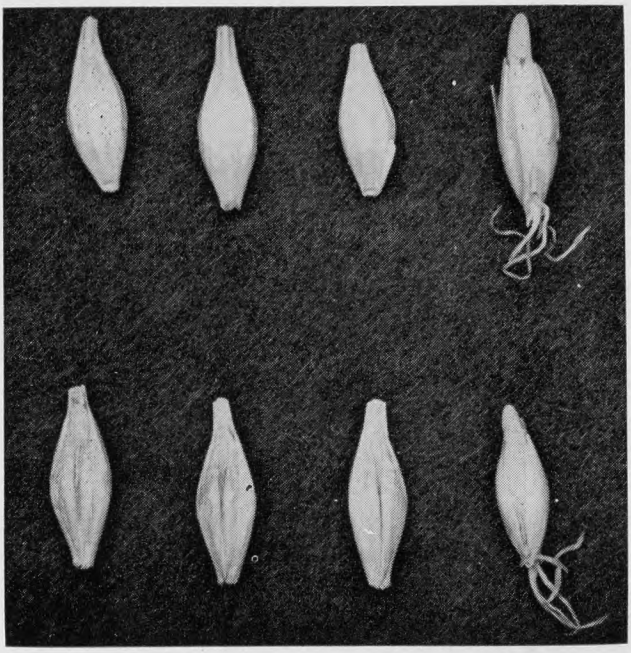
Another matter that bears close watching in swathing operations is the prevalence of stones. Small field stones or broken pieces of stone in malting barley create real problems for the maltsters. Some stones can be removed in the cleaning process but small pieces that are about the same size and close to the same weight as barley kernels cannot be removed. Samples of good malting barley have often been rejected because of stones that could not be removed. It is, therefore, important to lay the swath on a high stubble, if possible, so that the pickup does not contact the ground during the threshing operation. This problem is always greater in years when the crop is short and more difficult to harvest without running the pickup or even the straight combine table too close to the ground.

Threshing

Before discussing some of the mechanical adjustments which are so important in the proper threshing of malting barley, a word should be said about general threshing conditions. As already mentioned, barley should not be combined or threshed before the moisture content of the kernel has been reduced by drying to 14.8% moisture or lower but damage through peeling or cracking of the hull may result if the straw and chaff are too dry.

Many farmers thresh barley when they cannot thresh wheat or other grain, the ideal time being in the early morning or late evening when the kernels are dry but when the chaff and straw may be slightly tough from dew. There is a danger, however, that when both straw and grain are too tough, the result will be a loss of grain or a high percentage of damaged kernels for the reason that it is necessary to run the cylinder at higher speeds to prevent clogging and the cylinder and concave clearances have to be set close to get the grain out of the heads. All makes and models of combines can be adjusted to do a good job of threshing barley but careful attention by the operator to the condition of grain and straw throughout the day is very important.

Many operators believe, wrongly, that malting barley must have a maximum weight per bushel and must, therefore, be threshed close to provide a

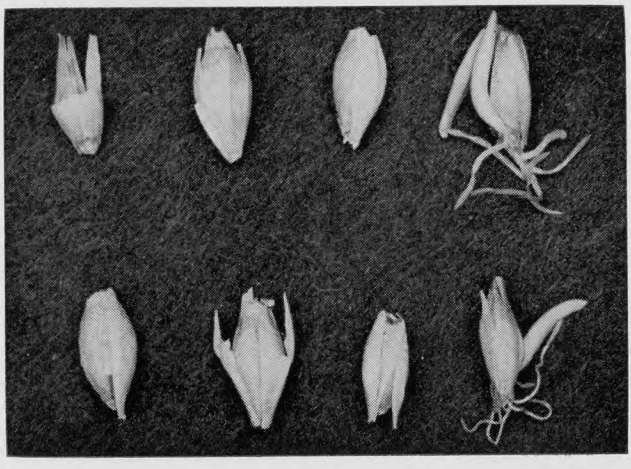


Left: Six properly threshed kernels with portion of awn attached (Long threshing).

Right: Two kernels during malting process. Sprout or acrospire is protected by the husk.

Left: Six skinned and broken kernels. (Too close threshing)

Right: Two kernels with sprout or acrospire not protected by husk during malting process.



clean sample, free of awns and chaff. While weight per bushel is important, absence from peeling is still more important. The most desirable kernel will have ⅛ to ¼ of an inch of awn attached so that there will not be the same danger of peeling and so that the kernel will be protected in subsequent handling.

It is sometimes difficult to obtain this ideal condition, particularly with Montcalm as the awn is inclined to be tough and the seed hull is brittle. Thus in attempting to remove too much of the awn, very often a portion of the hull is broken off which results in a cracked hull that is undesirable from the maltster's standpoint. Generally speaking, O.A.C. 21 and Olli thresh better than Montcalm or Parkland for the reason that the awns are more brittle and, therefore, break more easily; at the same time the hulls on these varieties are more firmly attached to the kernels.

Feeding the Thresher or Combine

Feeding the machine evenly and at slightly below its normal capacity will assist the straw walkers and the fan blast at the chaffer to do a better job of separating and saving the grain. These precautions are particularly important with barley because the matting tendency of threshed barley straw, beards and chaff requires special attention so that the mass will be broken up to permit the proper separation of the kernels from the straw and chaff. Quite often threshing damage is done to barley by trying to force too large a volume of grain through a cylinder that is being operated at a lower speed than that used for threshing wheat.

Cylinder Speed

Authorities point out that most of the damage done to barley in the past has resulted either from over-threshing (already mentioned) or from too high

Good malting barley degraded to No. 1 Feed on account of broken or cracked kernels.

a cylinder speed, or both. Studies show that most of the samples containing high percentages of skinned and broken kernels have come from machines

that were operating with cylinder bar speeds in excess of 6,000 feet per minute and that speeds above 6,200 fpm will damage grain regardless of the concave clearance. It was also shown that it is possible to reduce the percentage of damaged kernels considerably by reducing the cylinder bar speed, sometimes by as much as 300 to 400 per minute.

PERCENT DAMAGED KERNELS AT VARIOUS CYLINDER SPEEDS

Cylinder Speed (22" Cylinder)	Concave Clearance	Skinned & Broken
RPM-FPM		
1150-6612		9.0%
1100-6325	3/8"	7.0%
1000-5750		6.0%
925-5268		4.8%

Source: "Threshing Barley for Malting Purposes" by S. L. Vogel, North Dakota Agricultural College, N.D.

In other words, the higher cylinder speed usually required for threshing wheat must be reduced considerably when barley is being handled. An effective and much more gentle threshing action can be obtained at reduced speeds which may sometimes go as low as 5,000 feet per minute (the equivalent of 870 to 930 revolutions per minute with a 22" diameter cylinder.)

Concave Adjustments

The space between the concaves and cylinder should be in the widest setting that will provide proper threshing. Concaves should not be set to take off all the awn or beard on the kernel in order to increase the test weight since clearances that are narrower than absolutely necessary, will result in overthreshing and kernel damage. Relation between concave clearance and cylinder speed is definite; that is, the lower the cylinder speed, the closer can be the clearance. Spike tooth concaves should be set down at least half way and the cylinder and concave teeth properly aligned. The rasp bar cylinders do the best job of threshing when the cylinder and concave clearance is set between 3/8 and 5/8 inches.

CYLINDER & CONCAVE ADJUSTMENTS

Type of Cylinder	Cylinder & Concave Clearance	Percent Broken & Skinned Kernels at Cylinder Surface Speeds of FPM 4700	5000	5800	6000	*Notes
RUBBER FACED BAR CYLINDER	3/4 inch	1.0		2.0		
	11/16 inch	1.0		2.0		
	5/8 inch	1.0		3.0		
	9/16 inch	1.0		3.3		
	1/2 inch	1.0		5.0		Best Speed: 5100 to 5200 FPM
	7/16 inch	1.5		6.0		
	3/8 inch	2.0		7.0		
	5/16 inch	3.0		9.0		
	1/4 inch	4.0		—		
RASP BAR CYLINDER	5/8 inch		2.0		3.2	
	9/16 inch		2.0		5.0	Best combination is approximately 5000 FPM and 3/8-1/2 inch clearance.
	1/2 inch		2.0		6.5	
	7/16 inch		2.3		8.0	
	3/8 inch		2.5		10.0	
	5/16 inch		3.0		12.0	
	1/4 inch		3.9		14.8	Best Speed: 5000 to 5100 FPM
	3/16 inch		5.0		17.5	
Spike Tooth	RANGE OF CLEARANCE 2-4 Rows (Half Way Up to All the Way Down)					Best Speed: 5600 to 5700 FPM

Controlled Tests of University of Minnesota Experiment Station.
** Based on North Dakota Field Tests.*

N.B. Because cylinder diameters vary, it is not practical to state cylinder speed in RPM. Thus the term FPM is used. This is the circumference of the cylinder in feet x RPM.

By examining grain frequently as the moisture conditions during the day change, it is possible to make adjustments as needed to keep damage to a minimum. Varying the concave clearances will usually take care of these changes throughout the day.

PERCENT DAMAGED KERNELS AT VARIOUS TIMES OF DAY

Time	Cylinder Speed (20" cylinder)	Concave Clearance	Skinned & Broken
10.00 AM	1050 RPM or 5701 FPM	½"	1.0%
11.00			1.0%
12.00			1.0%
2.00			1.6%
3.00			2.0%
4.00			3.0%
5.00			4.5%

Source: "Threshing Barley for Malting Purposes" by S. L. Vogel, North Dakota Agricultural College, N.D.

Fan and Sieve Adjustments

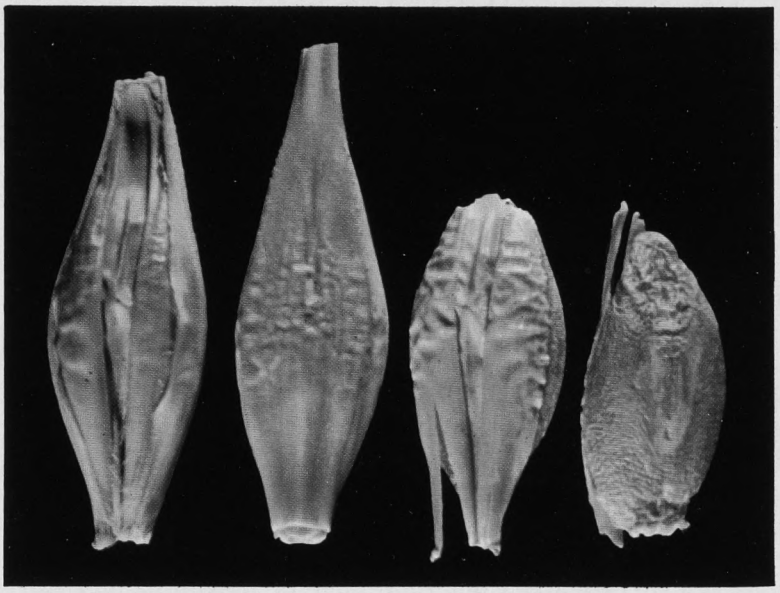
The fan should be operated at the same speed as for threshing wheat and the air valves should be opened fairly wide to provide a strong wind blast. The wind boards should direct the air blast to the front 1/3 of the shoe sieve and chaffer so that all grain and chaff are lifted clear of the chaffer sieve and so that the heavier barley kernels will fall on a clean chaffer sieve and pass through it easily. The adjustable chaffer sieve should be opened to about the 2/3 open position to allow plenty of air blast to pass through. More barley is lost by using too little wind than by using too much.

Sieves should be adjusted for the least possible return since a great deal of damage occurs on machines that are running with a heavy return. Where the latter situation occurs, a number of kernels are going through the cylinder a second time, thereby increasing the number of skinned kernels. Authorities suggest that it is much better to plan on cleaning the grain with a fanning mill after threshing than to attempt to clean it too closely in the threshing operation. It sometimes happens that barley with short beards will not pass readily through the cleaning sieve and a heavy return results. This problem can be overcome on the round hole sieve by placing retarder cross slats on top of the sieve to set the barley up on end, two or three cross slats with a rounded top surface about one half inch in height usually serving the purpose. Adjustable sieves may be opened wider and usually present fewer difficulties than the round hole types.

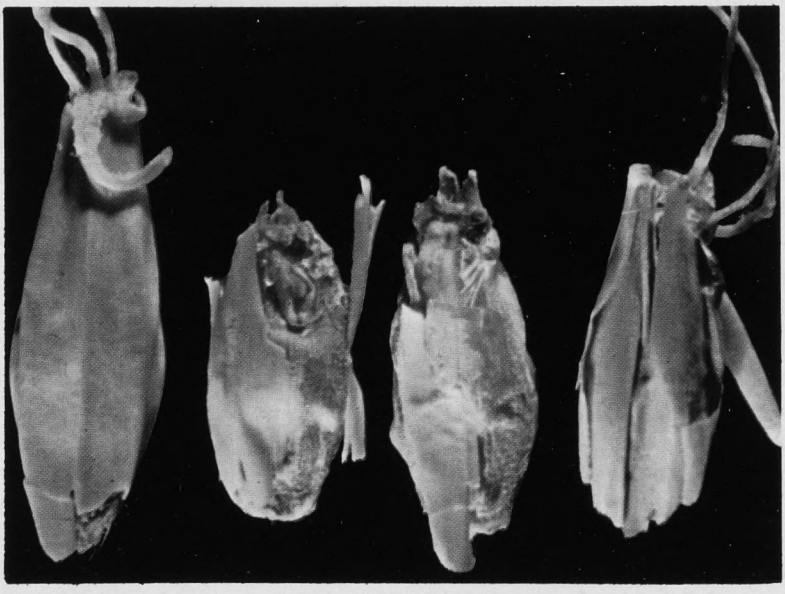
Operators using grain blowers should observe some precautions. Blowers can do considerable damage when run at a high speed but when run at the recommended speed little or no damage occurs. Many blower type elevators are run by a farm tractor, the best pully speed of which is usually too high at full throttle. Thus many farmers who have not checked the fan speed may be operating this equipment at speeds in excess of specifications, causing additional damage to the grain. Blower elevators may also cause cracking when not running at full capacity. Unless, therefore, the operator is prepared to take the special precautions discussed above concerning blower elevators, it is safer to use another type.

Handling After Threshing

It cannot be emphasized too strongly that it is important to reduce handling to an absolute minimum. If the barley has been properly threshed later handling does not seem to damage the grain to quite the same extent; nonetheless, it should be avoided as much as possible. If the barley has been damaged in threshing, however, it has been found that the damage becomes progressively worse every time it is handled. Thus, barley that comes from the threshing machine with say 3% to 4% of damaged kernels may well end up at its destination with two or three times that percentage of kernels that have become either peeled or broken. A little extra care given during threshing and harvesting will pay handsome dividends but, as suggested, some of this gain will be lost if the barley is handled too frequently.



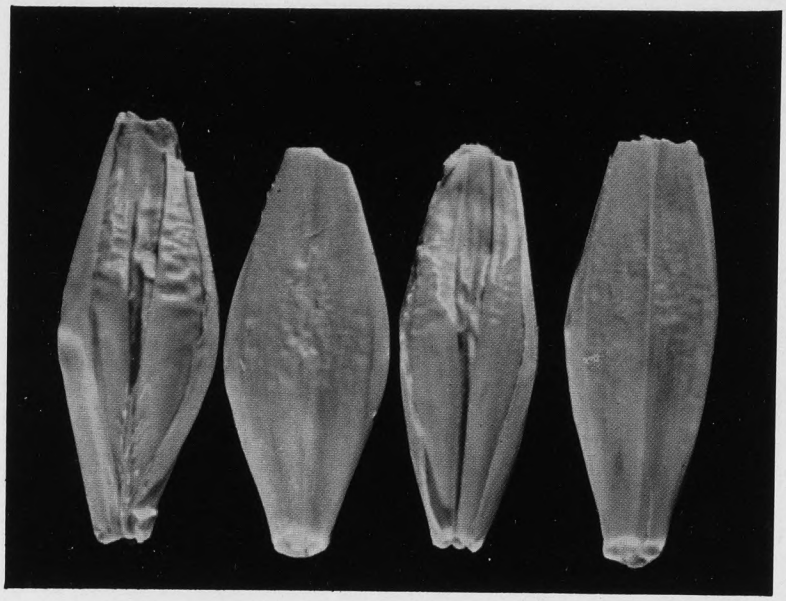
NORMAL PEELED



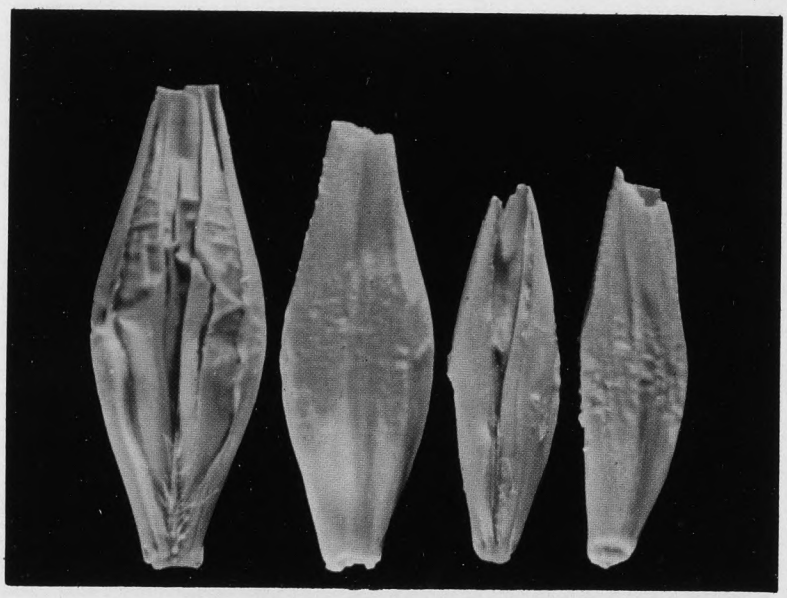
NORMAL PEEL DAMAGE

MALTED KERNELS

NOTE: All illustrations in colour appe
courtesy Grain Research Laboratory, Board

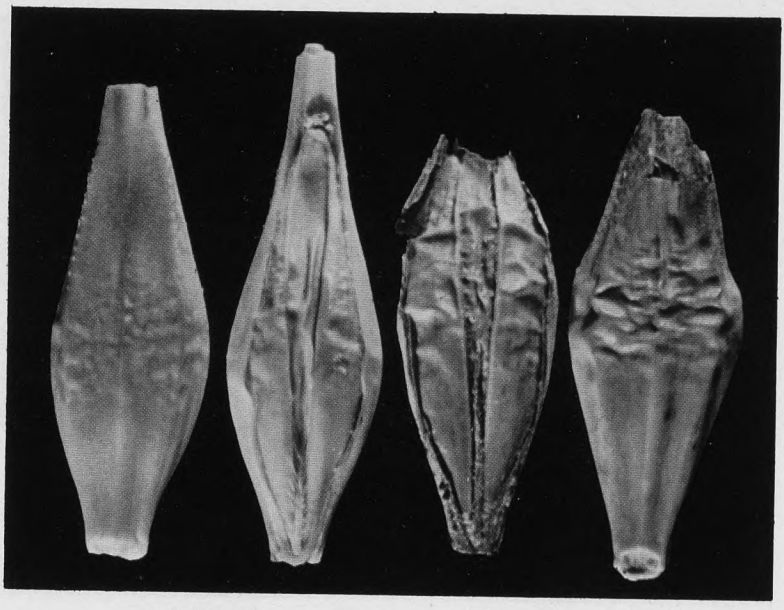


NORMAL GREEN



NORMAL SHRUNKEN

ur appearing on pages 16 to 20 inclusive
Board of Grain Commissioners for Canada.



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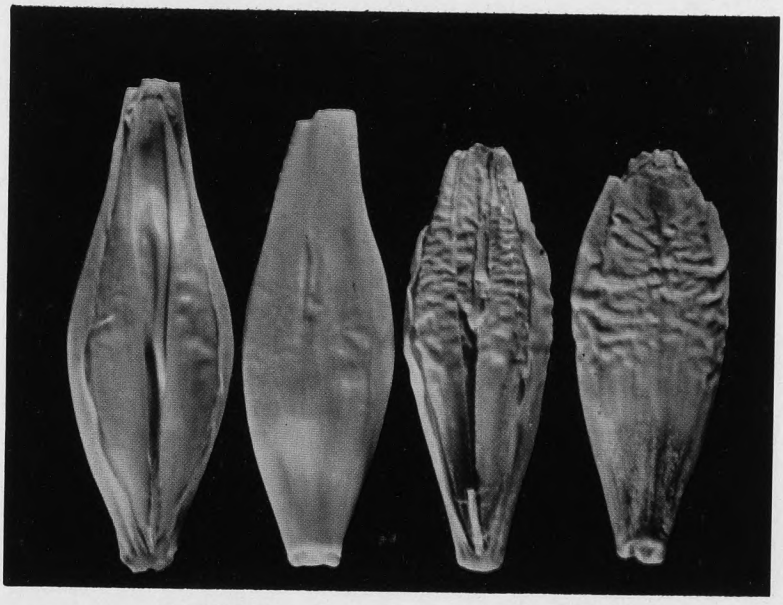

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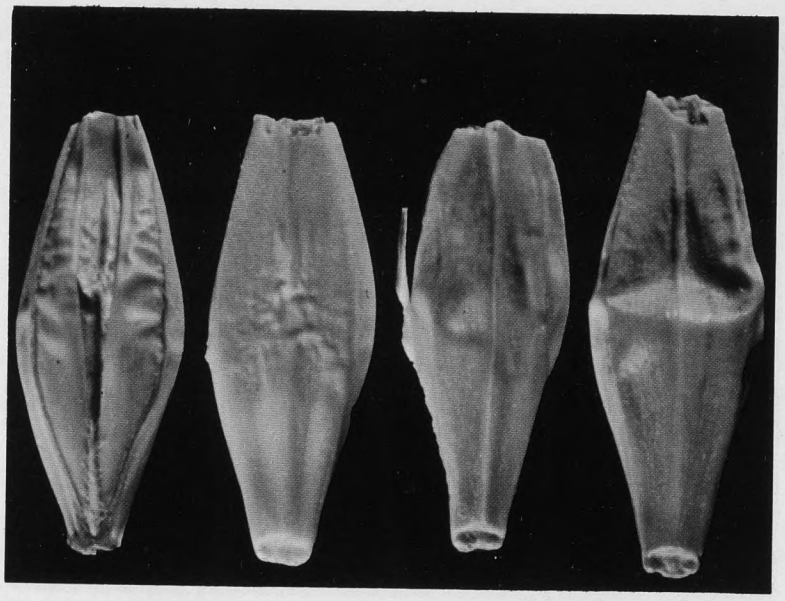

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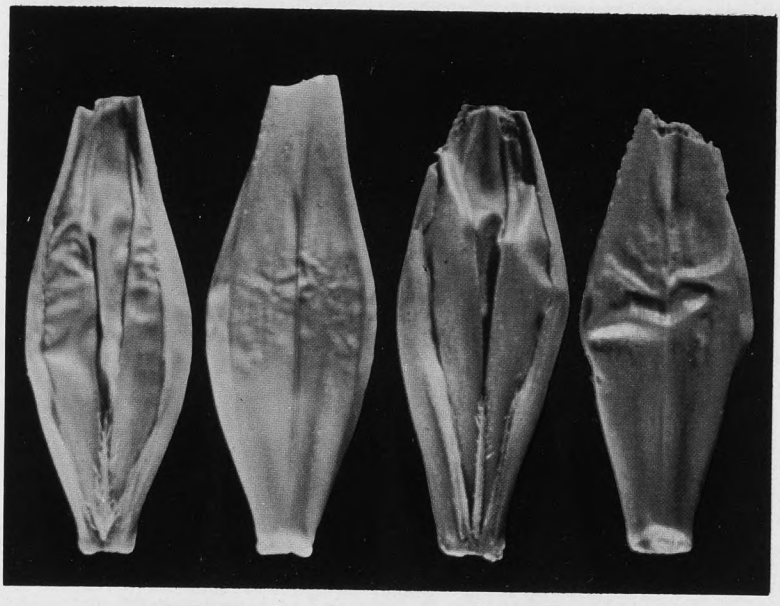

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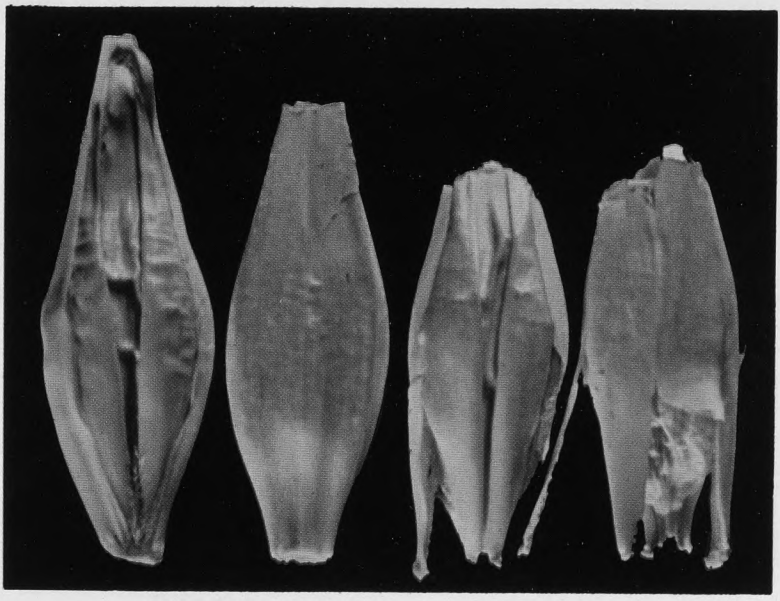

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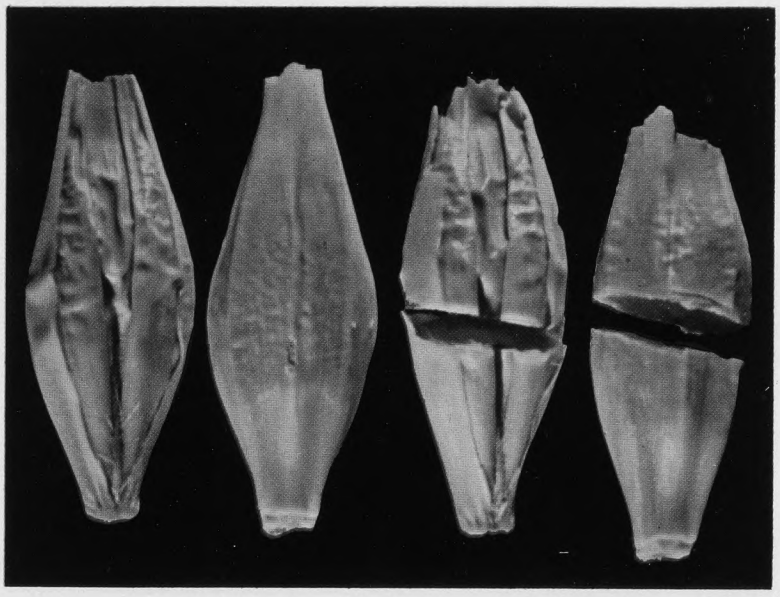


NORMAL BROKEN

Marketing Barley Through the Country Elevator

The farmer who intends to ship a carload of malting barley over the quota must first have his sample accepted either by an exporter or a malting company. It is important, therefore, to secure a **representative** sample for forwarding through the elevator agent, **as early as possible.**

The Usual Procedure

The usual sequence of events is that the agent retains a portion of the sample as a check to make sure that deliveries applying on the carload are up to the original sample. The balance of the sample he forwards to his head office who, in turn, submits the sample to the exporter and/or malting company. If the sample is accepted, head office immediately applies to the Canadian Wheat Board for a permit for the farmer to deliver and ship a carlot of barley as represented by the sample. Upon arrival in Winnipeg the agent's 2 lb. loading sample is inspected by the Inspection Department of the Board of Grain Commissioners. This sample is checked by the Company that has accepted the representative sample of the carlot. If the barley is equal to the sample, the car proceeds to its destination and upon unload, settlement is made basis the government unload grade and dockage plus the malting premium.

Some Problems That Arise

It sometimes happens, however, that through the farmer's anxiety to market the crop as quickly as possible, samples may be submitted from the first grain threshed and these may not represent the true quality of the entire field or the resulting carlot that is shipped to the malting company at a later date. The reasons for this may be beyond the farmer's control as, for example, subsequent frost damage or adverse harvesting conditions, or they may be due to variations of quality in the field or damaged barley resulting from improper threshing and handling. Whatever the reason, if the grain is affected to the point that it is no longer acceptable on a premium basis because the barley shipped is not of the same colour, appearance or quality as the original sample, it will be turned down and will become the farmer's responsibility so far as storage is concerned, applying against future deliveries on his quota. Fortunately, in a normal year, this situation rarely occurs. If it does so happen that the first sample of malting barley forwarded is turned down, the elevator agent who submitted it should continue to send samples of the barley to head office, from time to time, in case marketing conditions change, in which case it may be accepted at a later date.

Barley Improvement Work

Plant Breeding and Variety Evaluation

Barley improvement and research in Canada, now a co-operative effort in which Government, University and Industrial units all play a part, has undergone a great number of changes and adjustments over the years. In the early part of the century quality, as such, was not a real consideration in the production of barley and, prior to 1924, improvement in barley, in Canada, was accomplished by selecting the best plants from a mixture of types and increasing them. This is how the famous variety O.A.C. 21, still the standard of quality, was discovered.

It was only through the efforts of men like Peter Stewart and P. J. Dax in industry, Professor E. A. Lodds of Macdonald College, Professor Harrison of the University of Manitoba and others that the problems in malting barley were brought into sharp focus. Considerable progress has been made in recent years but much of the credit must be given to these pioneers in barley improvement who directed the thinking towards major problems in the earlier years.

An expansion of the barley program took place when the National Research Council, through the Associate Committee on Grain Research, organized a barley research laboratory in Ottawa in 1935. The malting laboratory at the University of Manitoba was consolidated with that of the National Research Council and in 1940 all malting research was transferred to the Malting Laboratory at the University of Manitoba. In 1942 the malting research was transferred to the Grain Research Laboratory of the Board of Grain Commissioners. Later, in 1948 the Barley Improvement Institute (now the Brewing and Malting Barley Research Institute) was organized by the malting and brewing industries. This body works very closely with the Grain Research Laboratory as well as with the Research Branch in an expanded program of fundamental research and supports research on barley at the universities.

Courtesy Experimental Farm, Brandon.

TRIAL PLOTS OF BARLEY
Showing Superior Straw Strength Parkland (left foreground) Compared with Montcalm (right foreground)

Barley improvement by hybridization was initiated in 1925 at Universities and Government Experimental Farms and from about 1932 on a succession of new hybrid varieties appeared. These were high yielding, more disease resistant and more acceptable in many respects but they lacked acceptable malting quality.

Quality Evaluation

By 1925 the development of laboratory equipment for malting barley samples had begun. At first malting laboratories were engaged in studies on the quality of existing varieties. In the 1940's, however, a very important advance was made when techniques were developed for predicting potential malting quality, using only a two ounce sample of barley. These prediction tests gave the plant breeder valuable and necessary information on the quality of the material with which he was working and enabled him to detect promising lines at a relatively early stage in the breeding program as well as to discard lines that were unsuitable.

It was not until 1945 that the first true malting barley variety, Montcalm, was released and more than 10 years passed before the release of a second good malting variety, Parkland, which, incidentally, was the first barley to have been tested at all stages in its development. During the period 1925-29 plant breeding was transferred from an art to a science. The brewing and malting industries, too, moved from an era of malting and brewing what was available and making the best possible use of an indifferent product to an era when they were able to lay down certain specifications and could be reasonably sure of obtaining barley and malt within these limits.

New Approaches

The present phase of barley research work began in the early 1950's when barley breeding programs at the Experimental Farms of the Canada Department of Agriculture were completely reorganized and expanded. As a result there are now active barley project groups in all regions in Canada and there exists a close co-operation between the Department of Agriculture and five universities, including the pioneer barley centres of Macdonald College and the Ontario Agricultural College. In these projects the one common link is the development of varieties with superior quality characteristics and, with many of them malting quality is a principal objective. The most promising lines from each station are entered in Cooperative Trials at many points across Canada. Malting tests are then conducted in conjunction with the agronomic trials. The results of these tests are examined by the Associate Committees on Plant Breeding, Grain Research and Plant Diseases. Finally, the advice of these committees is sought by the institution or individual proposing the variety for license.

The Cereal Quality Laboratory, a section of the Canada Department of Agriculture Research Station at Winnipeg, cooperates with barley breed-

ers in all parts of Canada. Its function is to select, from the thousands of lines produced each year by plant breeders, the few that appear to be the most promising in general malting quality. Further quality evaluation and final selection is made jointly by the Research Laboratory of the Board of Grain Commissioners and the Laboratory of the Brewing and Malting Research Institute. The three laboratories, though administratively separate, work together with the closest possible co-operation. Close liaison is also maintained with laboratories in other countries engaged in similar work and with domestic and overseas users of barley. Thus the three laboratories are co-operating in all projects where malting barley is a consideration.

As it is important that malting barleys and feed barleys should be distinguishable in kernel characters, the Inspection Branch of the Board of Grain Commissioners assist plant breeders by examining hybrid material and reporting to the plant breeder on kernel characters by which they may be identified.

Looking to the Future

At present research work in barley is being intensified and it is expected that, within a relatively short period of time, varieties will be produced that will be even better suited to the brewing and malting process as well as having many advantages from the producer's standpoint. Much has still to be learned about the nature of 'quality' and the inheritance of quality factors and considerable research is being devoted to this end.

Resistance to disease and insect pests is still an important objective in the breeding program. Barley production is being extended into areas where it had not been previously grown and new diseases as well as new forms of old diseases appear in these areas. Agronomic characteristics such as yield, resistance to lodging and early maturity are equally important. Modern methods of harvesting, threshing and handling grain have necessitated improvement in some of the physical properties of the grain. Hull adherence, for example, is an urgent problem requiring improvement at the present time.

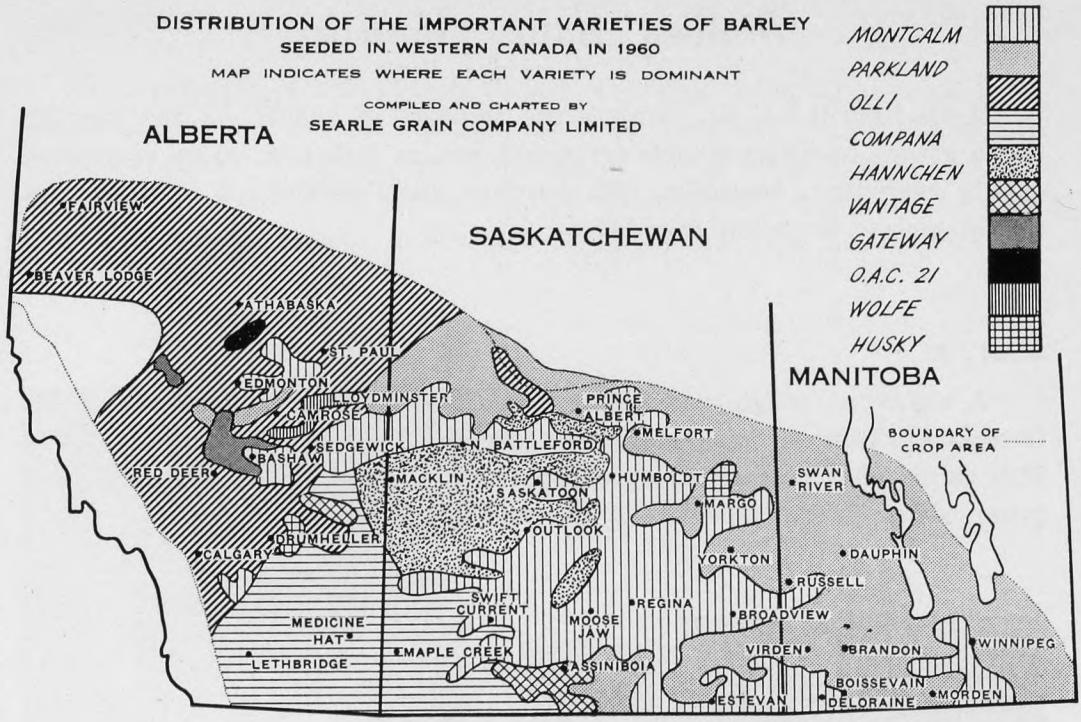
In closing it may be said that barley research and the whole barley improvement program today rests upon a firm foundation. Because of this it is possible to look forward to the future with confidence.

Distribution of Varieties

Until the distribution of **Parkland**, now grown to quite an extent in areas where **Montcalm** used to predominate, the variety pattern for six-rowed barleys had not changed very much for some years.

The same situation has existed with respect to the two-rowed barleys. However, the recent licensing and introduction of the varieties **Betzes** and **Palliser** is likely to bring a change in the pattern in those areas of Saskatchewan and Alberta which have, up to now, grown largely **Hannchen** and **Compana.**

The extent to which the main varieties of barley were grown in 1960 is outlined on the opposite page.



ESTIMATED 1960 ACREAGE AND PERCENTAGE OF LEADING VARIETIES OF MALTING AND MILLING TYPES OF BARLEY

	ALBERTA		SASKATCHEWAN		MANITOBA		PRAIRIE PROVINCES	
	Acreage (000)	% Of Total Alberta Acreage	Acreage (000)	% Of Total Sask-atchewan Acreage	Acreage (000)	% Of Total Manitoba Acreage	Acreage (000)	% Of Total Prairie Provinces Acreage
MALTING								
Montcalm	314	9.0	964	36.6	318	29.7	1,596	22.2
Parkland	382	10.9	626	23.8	609	56.9	1,617	22.5
Olli	1,100	31.5	—	—	—	—	1,100	15.3
Sub Total	1,796	51.4	1,590	60.4	927	86.6	4,313	60.0
MILLING								
Hannchen	—	—	492	18.7	—	—	492	6.8
Compana	392	11.2	143	5.4	—	—	535	7.4
Sub Total	392	11.2	635	24.1	—	—	1,027	14.2
Total MALTING & MILLING Types	2,188	62.6	2,225	84.5	927	86.6	5,340	74.2

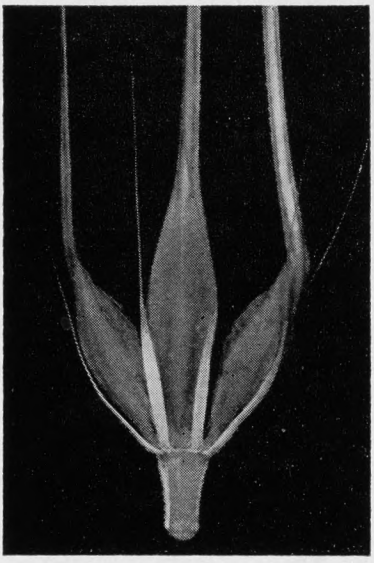
Source: Searle Grain Co. Survey of Barley Varieties (1960).

Malting Barley Varieties

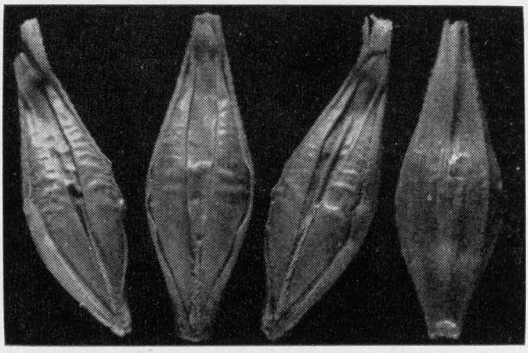
Aside from **O.A.C. 21,** which is the standard of quality for the top six-rowed grades, varieties eligible for acceptance by maltsters, on an equivalent quality basis, are: **Montcalm, Olli, Gateway** and **Parkland.** A brief description of each of these varieties follows:

O.A.C. 21

A six-rowed, rough-awned barley developed from a selection made at the Ontario Agricultural College and first brought to Western Canada about 1912. This variety fast became the most popular one in Canada and at one time was grown almost to the exclusion of all other varieties.



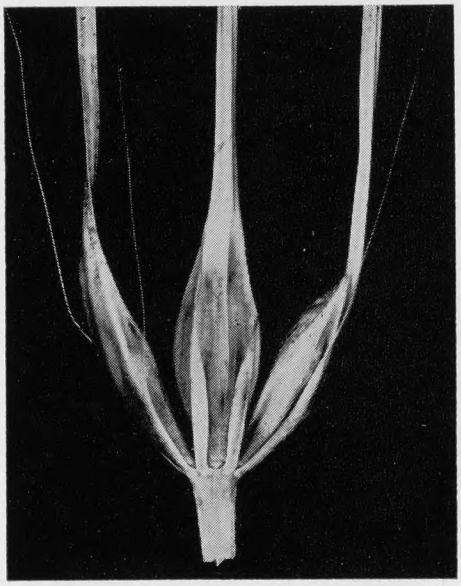
O.A.C. 21



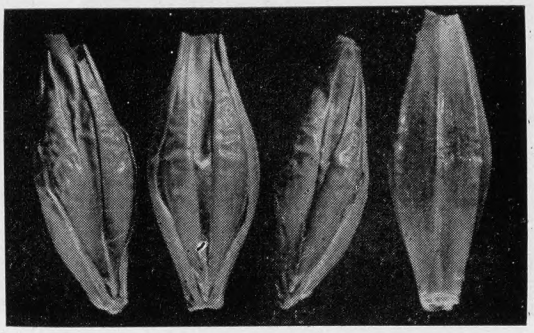
O.A.C. 21 is a blue aleurone variety. It has a nodding head and when ripe, has a tendency to "neck", that is, to break at the neck about 3 to 6 inches below the head. In dry, windy weather, considerable loss takes place if the grain is allowed to become properly ripened. It has a moderately stiff straw, is quite susceptible to stem rust, but is quite resistant to both loose and other smuts. This variety, as the standard for all malting varieties, is sought after by the malting trade. The acreage devoted to O.A.C. 21, however, is now very small although the variety is still grown in scattered areas in all three prairie provinces.

MONTCALM

A six-rowed, smooth-awned variety developed from a cross made at Macdonald College, Quebec, and released to growers and licensed for sale in Canada in 1945. Montcalm was recommended for all areas where O.A.C. 21 had been the predominant variety and, for some years, it has been the main variety grown for malting in Western Canada, particularly in Manitoba and Saskatchewan.



MONTCALM

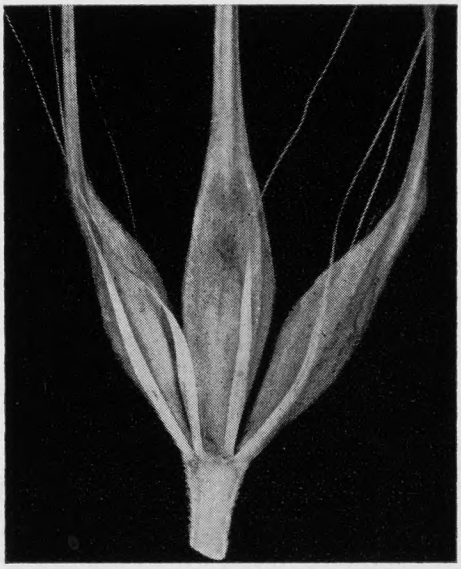


Montcalm is a blue aleurone variety and outside of its smooth-awn, it is, in many respects, quite similar to O.A.C. 21. The straw is moderately strong and it is not as subject to "necking" as O.A.C. 21. It is somewhat more difficult to thresh in that it peels more easily and portions of the rachis adhere to the kernel causing a larger loss in cleaning before malting. It is not rust resistant and it is more susceptible to smut than O.A.C. 21. Under normal conditions, it yields several bushels more per acre and gives 1 to 2% higher extract than O.A.C. 21.

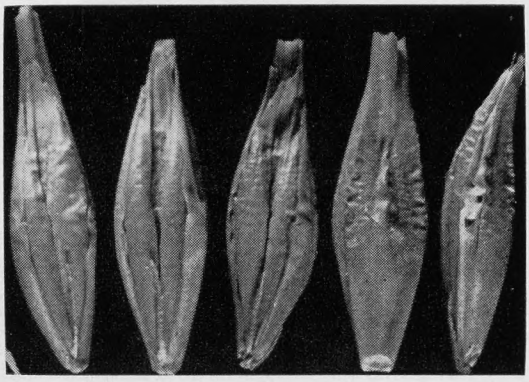
Manitoba Variety Recommendations for 1961 show Montcalm as second choice to two relatively small areas, one in the north-western part of the province and the other in the north-east. In Saskatchewan this variety is recommended where neither rust nor drought is a hazard — that is, essentially in northern areas.

OLLI

A six-rowed, rough-awned barley selected at the Central Experimental Farm, Ottawa, from a seed lot introduced from Finland in 1930. This variety was released for growing in 1936 and was licensed for sale in Canada the same year. Olli is a popular variety in northern and parts of western and central Alberta where it is accepted for malting and is used in considerable quantities by the trade.



OLLI

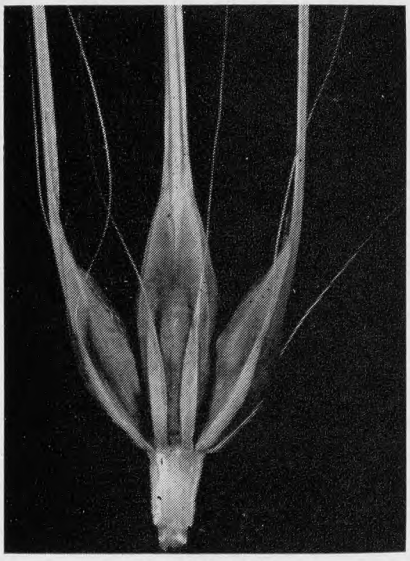


The variety Olli contains an aleurone that is predominantly blue with white grains invariably present. It has an early erect growth, moderately stiff straw and is tolerably resistant to smut. This variety has a tendency to shed its awns and to partially tear back the hull. Normally, however, the hull is quite tight. It is generally about two weeks earlier than O.A.C. 21. In the high altitude, short season area of Alberta it produces a large plump kernel with a very high extract. In other regions, particularly in Saskatchewan and Manitoba, however, it produces a "shoepeg" type of kernel which is not wanted by the malting industry.

Alberta Variety Recommendations for 1961 show Olli as being suitable for the extreme western part of the province and for some northern areas including most of the Peace River Territory. Olli continues to be grown in Alberta because of the demand from maltsters for this variety.

PARKLAND

A six-rowed, smooth-awned barley resulting from a cross made at the Experimental Farm, Brandon, in 1946. This variety was licensed for sale in Canada in 1956. It has proved to be widely adapted and has generally yielded more than O.A.C. 21 and Montcalm.

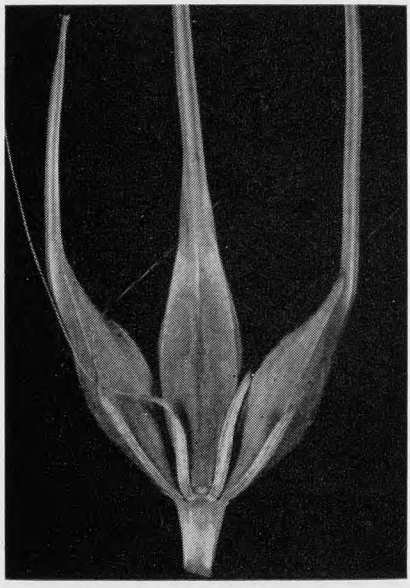


PARKLAND

Parkland is a blue aleurone variety. The straw is of medium length and moderately strong and the variety appears to be more resistant to lodging than either Montcalm or O.A.C. 21. It possesses a high degree of resistance to the prevailing races of stem rust but is moderately susceptible to smut. 1961 Variety Recommendations for Manitoba show Parkland as the recommended variety in all crop districts of the province. In Saskatchewan it is especially recommended where either rust or drought is a hazard. In Alberta it is recommended in most of central Alberta and in all but a small area of the Peace River Territory.

GATEWAY

A six-rowed, smooth-awned barley from the cross (Newal x Olli F^6) x $Olli^2$ made at the University of Alberta. This variety was licensed for sale in Canada in 1953. Although it is classed as being equal to O.A.C. 21 in malting quality and it is now included in the malting grades, it has not as yet been accepted too readily by the malting and brewing industries.



GATEWAY

Gateway is a white aleurone variety which, throughout central Alberta, requires one or two days longer to mature than Olli. It has, however, outyielded that variety on the black soils of Alberta and in many tests on the grey-wooded soils. It is short to mid - tall in the straw and it is also moderately susceptible to smut. The variety appears to be best adapted to central and northern Alberta where it is still on the recommended list for 1961 prepared by the Alberta Varietal Zonation Committee. It is not listed by this Committee, however, as being in demand by the trade.

Milling Varieties of Barley

The standard of quality for the top two-rowed grades of barley is **Canadian Thorpe,** an old-time variety now seldom grown. From the standpoint of the pot and pearling and the milling industries, however, the two most important varieties up to the present time have been **Hannchen** and **Compana.** The former has been in demand at home for pot and pearling and the latter in the special export market to Japan where barley is normally processed for human consumption. **Betzes,** a new variety licensed for sale in Canada in 1960, has found favour among both growers and commercial users. **Palliser,** another new variety licensed in 1960, is considered superior to Compana in many respects which it is likely to replace. A brief description of these four varieties follows:

HANNCHEN

A rough-awned, two-rowed variety which originated from a plant selection made from "Hanna" at the Plant Breeding Station, Svalof, Sweden. Most of the Hannchen grown in Canada comes from a selection made by the University of Saskatchewan, and licensed prior to 1923. At the present time Hannchen is grown fairly extensively in Northern and North Central Saskatchewan where, in some areas, it is the predominant variety.

Hannchen produces medium plump, shallow-creased kernels with a yellow aleurone. The head is lax and nodding. It has a medium stiff straw and is considered moderately resistant to stripe disease.

COMPANA

A smooth-awned, two-rowed variety released in the U.S.A. in 1941 and later licensed for sale in Canada, where it seems quite well adapted in the drier, non-irrigated lands of Southern Alberta and Southwestern Saskatchewan.

Compana produces a fairly plump kernel with a yellow aleurone. It has a lax head, erect to slightly nodding. It is considered resistant to loose smut and moderately resistant to covered smut and is said to be less susceptible to grasshopper damage. It is moderately early in maturity but is inclined to be weak in the straw.

BETZES

A two-rowed, rough-awned spring barley introduced into North America from Krakow, Poland. Betzes is superior to Hannchen in yielding potential and resistance to lodging, and equal in malting and pearling quality. It is superior to Compana in yielding ability, lodging resistance, and pearling and malting quality, but is more susceptible to shattering.

Betzes is a yellow aleurone variety, with medium length of straw and medium strength. It is expected that it will be grown in the Hannchen area of Alberta and Saskatchewan.

PALLISER

Is a two-rowed, semi-smooth awned variety developed at Lethbridge by the Dry Land Area Project Group of the Canada Department of Agriculture from the cross Vantage x Compana. It is very similar to Compana in seed type

but is taller, more resistant to lodging, somewhat higher in yield potential on the Brown and Dark Brown Soils, somewhat later in maturity and equally resistant to shattering. It is slightly superior to Compana in pearling quality but it is inferior to both Hannchen and Betzes in this respect. Primarily because of its superior straw characteristics it is expected that this variety will replace Compana in the Compana areas of Alberta and Saskatchewan.

Commercial Demand

Merchandisers of both malt and malting barley recognize that varieties of barley have to pass the test of consumer demand. Canadian Maltsters, in addition to serving the domestic market, have to meet the requirements in the countries to which they export.

Barley exporters are concerned chiefly with what they can merchandise in the U.S.A. but they also try to satisfy the wants of other countries.

The domestic maltsters find their customers prefer chiefly Montcalm and Olli but increasing quantities of Parkland are being used. There is still some demand for the variety O.A.C. 21. Montcalm continues to be the chief variety sought by the export market but they also take some Olli, some Parkland and some O.A.C. 21.

Recently there has been some interest, both domestic and export, for Two Row Hannchen and Betzes. This is a new development and only low protein barley is considered.

Some Special Considerations

It is not the purpose of this bulletin to refer to the cultural practices, methods of weed control, diseases and other matters relating to the growing of the barley crop. These matters have all been dealt with very fully in various other publications that have appeared from time to time. Several accepted practices which go hand in hand with the successful raising of 'quality barley', however, should perhaps be mentioned briefly here. These include:

1. **The Use of Pure Seed**

The use of high quality seed that is true to variety cannot be over-emphasized. Registered and Certified seed of the approved varieties is readily available. This seed carries with it the stamp of approval of the Canadian Seed Growers' Association and of the Plant Products Division of the Canada Department of Agriculture.

2. **The Advisability of Seeding Early.**

Barley sown reasonably early in the season does better, on the average, than that which is sown late.

3. **Advisability of Shallow Seeding.**

Provided the barley is sown in a firm seedbed and is in contact with moisture, shallow seeding means a quicker emergence, a more uniform stand, healthier seedlings and, everything else being equal, a higher yielding crop.

Acknowledgments

We wish to acknowledge, with thanks, the valuable assistance given by **The Research Branch, Canada Department of Agriculture,** as well as by the following individuals without whose helpful advice the production of this bulletin on "Malting Barley" would not have been possible.

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We should also like to express our thanks to the following for the photographs which have been used for illustrative purposes throughout this bulletin:- **The Research Branch, Canada Department of Agriculture; The Mid-West Barley Improvement Association,** Milwaukee, Wisconsin and **The Grain Research Laboratory, Board of Grain Commissioners for Canada,** Winnipeg, Manitoba. In this connection we are especially indebted to **Mr. R. J. Cheale** of the Grain Research Laboratory staff for his kind technical assistance with the coloured section of the bulletin.